

OBSERVATIONS ON SOME AUSTRALIAN FOREST INSECTS.

12. THE TAXONOMY OF *ZENARGE TURNERI* Rohwer (1918) (HYMENOPTERA: ARGIDAE),
THE CYPRESS PINE SAWFLY.

By K. M. MOORE, Forestry Commission of New South Wales.

(Six Text-figures.)

[Read 30th May, 1962.]

Synopsis.

Attack by larvae of *Zenarge turneri* Rohwer (cypress pine sawfly) on State Forests of indigenous *Callitris hugelii* (Carr.) and on other ornamental *Callitris* and *Cupressus* spp. is widespread in New South Wales.

The taxonomy of the species was investigated and *Zenarge turneri rabus*, subsp. nov., is described. This taxonomic interpretation is supported by the results of biological investigations presented in another paper in these PROCEEDINGS.

INTRODUCTION.

From an examination of numerous specimens of this insect collected throughout its known range of distribution in New South Wales during the incidence of large populations on State Forests, it was determined that the description given by Rohwer was not applicable to specimens occurring in the western districts. There was thus some doubt concerning the taxonomy of *Zenarge turneri*, and aspects of its morphology, distribution, hosts and general biology were investigated.

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ZENARGE TURNERI Rohwer 1918.

The genus is monotypic.

The original description of the species by Rohwer (1918) was based on one male and two female specimens collected at Killara, Sydney (type locality), on 17th August, 1913, by R. E. Turner, after whom the species was named. In that paper it is stated that a type female and an allotype male were deposited in The British Museum (Natural History) and a paratype female in the United States National Museum. In a personal communication (July, 1961) Dr. R. B. Benson of the British Museum mentioned that there were 2 ♀♀ and 4 ♂♂ (including holotype and allotype) in the original type series in the British Museum collection, and all bear corresponding label data, namely, "N.S.Wales, Sydney. 400 ft., Aug. 17, 1913, R. E. Turner".

Additional observations on Australian sawflies were recorded by Morice (1919), who gave figures of the left wings and the antenna of a male, and the middle tibia, the saw and support of a female of *Z. turneri*.

Froggatt (1923) collected larvae of *Z. turneri* on *Frenella robusta* (= *Callitris* sp.) at Wagga Experiment Farm, but from an examination of label data on the only six female adult specimens known from that locality it is possible that McKeown, then the manager of the Experiment Farm, reared the larvae to the adult stage at Wagga. Froggatt's name does not appear on any of the labels, and McKeown's name is in parentheses on labels attached to five of these specimens. This is not consistent with Froggatt's method of labelling, and the data are given under "Specimens Examined".

Benson (1945) refers to the apparent primitiveness of this insect, with its unique host-association, and this is consistent with the phylogeny of the indigenous *Callitris* spp. which are considered to be a primitive group.

Specimens corresponding to the description of the type ♀ have been collected in New South Wales by the writer, at Wentworth Falls, Woodford, Armidale, Pennant Hills, Maroota, Kulnura and Broke. These specimens were relatively homogeneous as a separate group, larger than those occurring on *C. hugelii* in western districts (Table A), and the coloration of the female abdomen, except for the black areas, was consistently ferruginous as described by Rohwer (Table B).

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From an examination of a large number of specimens from many areas throughout western New South Wales, the morphology, colour characteristics and host associations of these populations were found to be also relatively homogeneous even though certain differences in coloration occurred between localized populations (Tables B, C and D). Rohwer's description of the ♀ type specimen was not applicable to specimens of these populations.

A new subspecies based on the results of investigations into the biology and morphology of numerous specimens reared and collected from many areas is erected for specimens of the western populations.

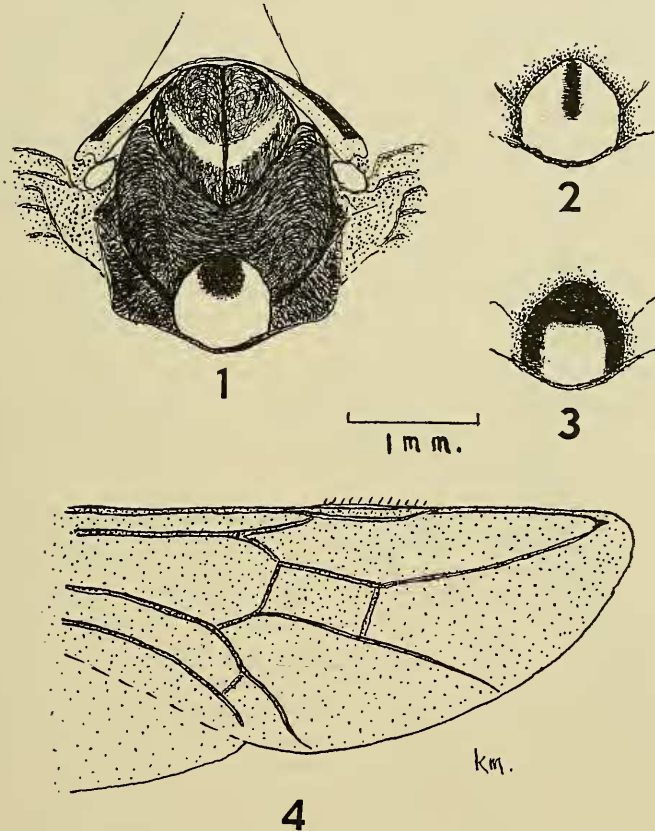


Fig. 1.—Thorax of adult of *Zenarge turneri rabus*, subsp. nov., showing white crescent on prescutum and black spot on scutellum of females.

Fig. 2.—Scutellum of female adults from Wagga, showing black bar (*Zenarge turneri rabus*, subsp. nov.).

Fig. 3.—Scutellum of female adults of *Zenarge turneri turneri* from Wentworth Falls, showing white area.

Fig. 4.—Portion of hindwing of *Zenarge turneri rabus*, subsp. nov., showing prolongation of apical vein.

ZENARGE TURNERI RABUS, subsp. nov. (here designated).

(*L. rabus* = dark coloured.)

Type Locality: Corringale State Forest, Compartment 1; 20 miles north of West Wyalong (Forbes Forestry District, West Wyalong Subdistrict).

Holotype ♀: Length (excluding antennae) 8.0 mm. Length of forewing 7.6 mm. Head with black area surrounding ocelli and extending almost to eyes and bases of antennae, and to posterior aspect of head where it extends laterally to half of eyes; a brown mottled area between eyes and posterior aspect of head; remainder creamy white;

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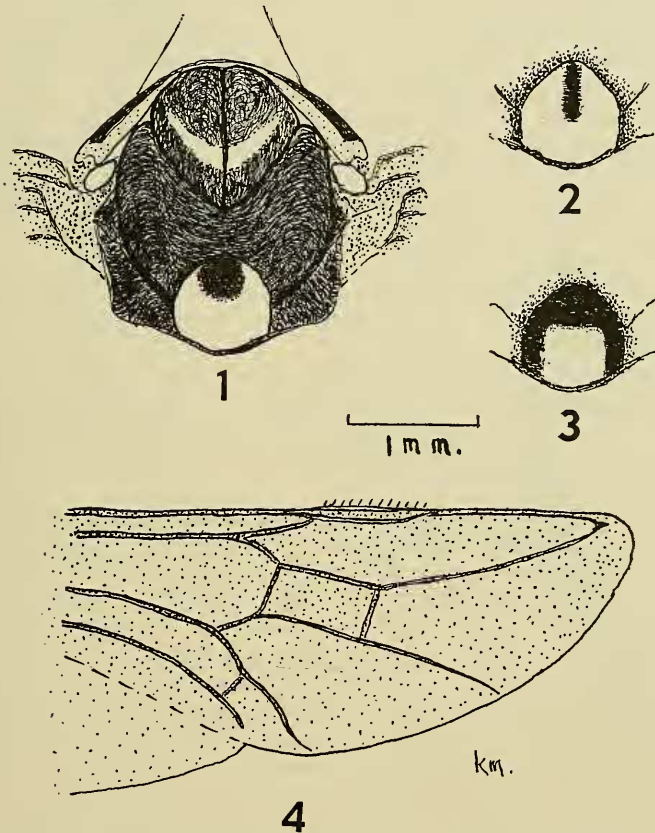


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mandibles tipped black. Prescutum black, with a white crescent convex posteriorly, near posterior border (Figure 1). Scutellum white, with a small anterior median black spot (Fig. 1). All abdominal segments are black dorsally; intersegmental areas and ventral abdomen are cream to pale yellow. Subcostal vein of hindwing produced beyond tip of cell R_1 (Fig. 4). Posterior tibiae black. Each leg with two distal tibial spurs; middle tibiae each with two preapical spurs; hind tibiae each with one preapical spur; posterior tarsi with two proximal segments black, and the three distal segments creamy white.

The type ♀ specimen has been selected to represent the extreme in the range of coloration, by which it may be separated most readily from *Zenarge turneri turneri*.

The females of *Zenarge turneri rabus* may always be separated from those of *Zenarge turneri turneri* as the posterior tibiae are all black, while in the latter species they are always white proximally for about one-quarter of their length.

Allotype ♂: Length, 7.5 mm. Length of forewing, 6.0 mm. Prescutum without white mark. Scutellum with anterior third black, remainder creamy white. Abdomen ferruginous with segment two black dorso-laterally and segment six with an indistinct dark transverse line across anterior border. Subcostal vein of hindwing produced beyond tip of cell R_1 . Posterior tarsi with three proximal segments black, and two distal segments white.

No constant colour characteristic or morphological difference was found in the males of this subspecies to separate them from those of *Zenarge turneri turneri* (Tables A, C and D).

Host Plant: Callitris hugelii (Carr.) Franco (white cypress pine).

Types: The holotype ♀ labelled "Corringle S.F., 19 x 1957, K. M. Moore. Emerged 10 ii 1958" and allotype ♂ labelled "Corringle S.F., 19 x 1957, K. M. Moore. Emerged 2 xii 1957", together with a slide of the saw of the holotype, are lodged with The Australian Museum, Sydney, N.S.W.

Paratypes: A series of 162 ♀♀ and 130 ♂♂, designated paratypes, are distributed as follows: *To The Australian Museum*, Sydney: 11 ♀♀, 2 ♂♂, Corringle S.F., 6 x 1960, K. M. Moore; 16 ♀♀, 4 ♂♂, Corringle S.F., 19 x 1957, K. M. Moore; 8 ♀♀, 2 ♂♂, Corringle S.F., 23 ix 1959, K. M. Moore; 8 ♀♀, 2 ♂♂, Strahorn S.F., x 1960, K. M. Moore; 1 ♀, 1 ♂, Dubbo N.S.W., 17 x 1957, K. M. Moore; 1 ♀, 3 ♂♂, Red Hill S.F., 25 ii 1959, K. M. Moore; 1 ♀, Mandalong N.S.W., 6 iii 1958, K. M. Moore; 1 ♀, Mandalong N.S.W., 27 ix 1959, K. M. Moore; 2 ♂♂, Mandalong N.S.W., 23 iii 1958, K. M. Moore; 2 ♀♀, Lakeview S.F., 18 x 1957, K. M. Moore; 2 ♀♀, 2 ♂♂, Matong S.F., 6 ii 1957, K. M. Moore; 6 ♀♀, 8 ♂♂, Matong S.F., 22 x 1957, K. M. Moore; 3 ♀♀, 15 ♂♂, Buckingham S.F., 21 x 1957, K. M. Moore; 10 ♀♀, 15 ♂♂, Buckingham S.F., 5 ii 1957, K. M. Moore; 2 ♂♂, Buckingham S.F., 6 ii 1957, K. M. Moore; 15 ♀♀, 35 ♂♂, Olney S.F., 31 x 1957, K. M. Moore; 13 ♀♀, Olney S.F., 14 ii 1958, K. M. Moore; 2 ♀♀, 5 ♂♂, Olney S.F., 26 ii 1958, K. M. Moore; 7 ♀♀, 12 ♂♂, Olney S.F., 3 vi 1958, K. M. Moore. *To The British Museum (Natural History)*, London: 10 ♀♀: Corringle S.F., 19 x 1957, K. M. Moore (4); 23 ix 1959 (2); 6 x 1960 (3); 11 x 1961 (1). 4 ♂♂, Corringle S.F., 19 x 1957, K. M. Moore. *To the Division of Entomology, C.S.I.R.O.*, Canberra: 10 ♀♀: Corringle S.F., 19 x 1957, K. M. Moore (5); 23 ix 1959 (1); 6 x 1960 (4). 4 ♂♂, Corringle S.F., 19 x 1957, K. M. Moore. *To the N.S.W. Department of Agriculture*: 10 ♀♀: Corringle S.F., 19 x 1957, K. M. Moore (6); 6 x 1960 (4). 4 ♂♂, Corringle S.F., 19 x 1957, K. M. Moore. *To the Forestry Commission of N.S.W.*: 10 ♀♀: K. M. Moore. *To the Queensland Museum*, Brisbane: 10 ♀♀: Corringle S.F., 19 x 1957, K. M. Moore (5); 6 x 1960 (5). 4 ♂♂, Corringle S.F., 19 x 1957, K. M. Moore.

Seven slides of ♀ and ♂ genitalia, and five slides of ♀ and ♂ genitalia of *Zenarge turneri turneri* from Armidale, Wentworth Falls and Pennant Hills, as well as one slide showing three saws of crossed specimens, are also lodged with The Australian Museum.

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(McKeown) 1906". In the N.S.W. Department of Agriculture collection, 4 ♀♀, two on each of two cards labelled "Wagga. Larvae on *Frenella robusta*. (McKeown) 1906". In the Macleay Museum, University of Sydney, 1 ♂, labelled "Wagga".

There is 1 ♀ specimen and 1 ♂ specimen in the U.S. National Museum labelled "Wagga. N.S.Wales. Larvae on *Frenella robusta*. Oct. ? 1906", which have not been examined by the writer.

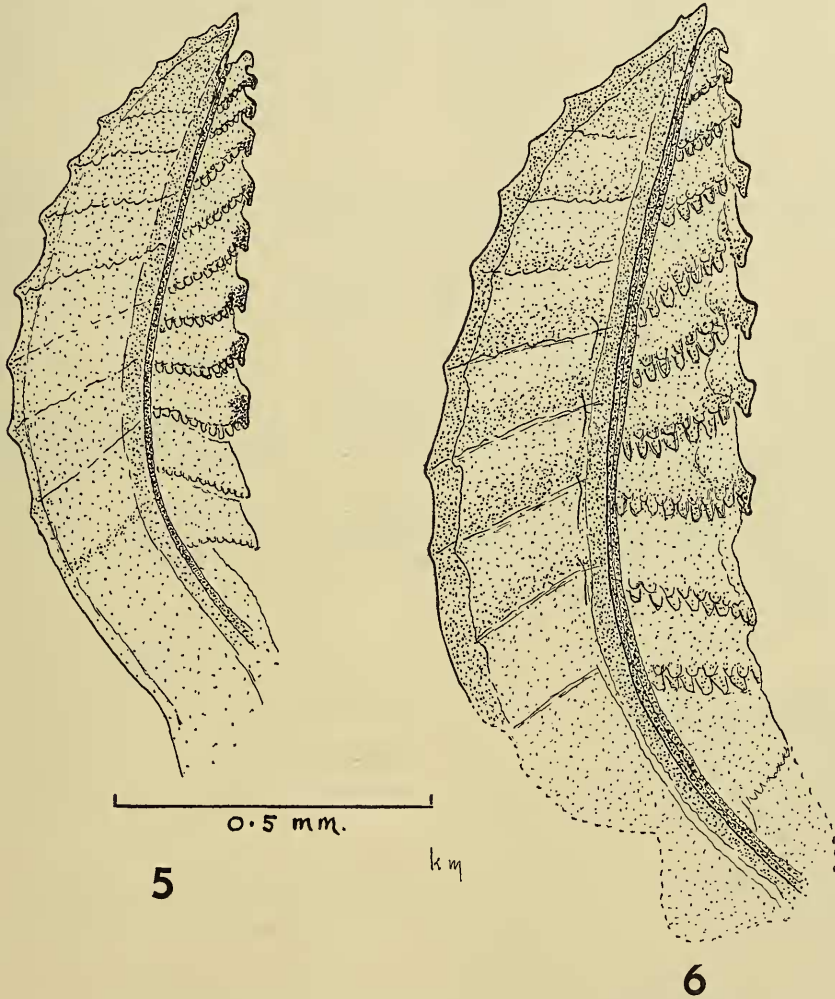


Fig. 5.—Saw and ovipositor of holotype ♀ *Zenarge turneri rabus*, subsp. nov.

Fig. 6.—Saw and ovipositor of ♀ (type series) of *Zenarge turneri turneri* in the British Museum.

Several hundred specimens from Corringale State Forest, Matong S.F. and Buckingham S.F. (Wagga District); Strahorn S.F. and Bidden S.F. (Dubbo District); Olney S.F. and Mandalong (Newcastle District); Green Hills S.F. (Tumut District) and several other western State Forests have also been examined.

The saw and ovipositor of the type ♀ of *Zenarge turneri rabus*, and of a ♀ of the type series of *Zenarge turneri turneri* in the British Museum, are given in Figures 5 and 6 respectively, and characteristics of saws of the two subspecies are given in Table E.

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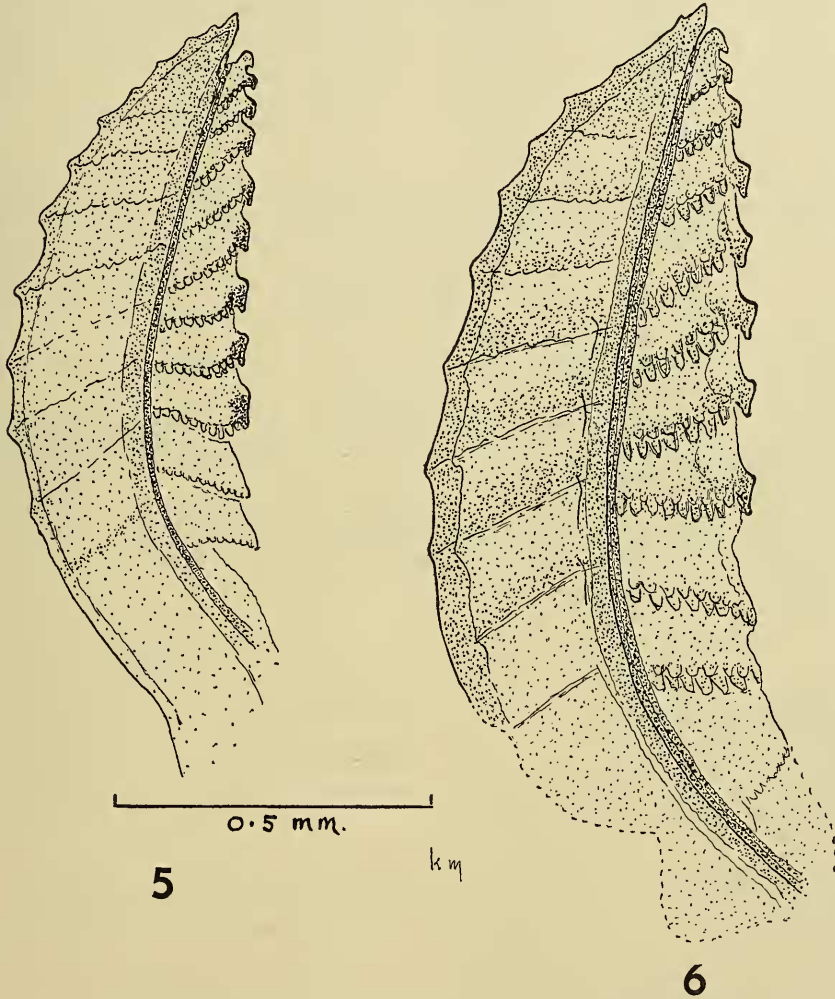


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Coloration of the males is not significant for taxonomic purposes, but setae on the head, thorax and abdomen of ♀♀ and ♂♂ are more sparse in *Zenarge turneri rabus* than in *Zenarge turneri turneri* and punctures are smaller and more sparse.

Most of the wing venation was found to be variable, inasmuch as cross veins were often absent, or present only in part, or portions of veins were evident where they normally did not occur; even so, a small prolongation of the subcostal vein of cell R₁ of the hindwing (Fig. 4) was relatively constant in *Zenarge turneri rabus* and usually only doubtfully occurred in a few specimens of *Zenarge turneri turneri* (Table C).

A white mark, often in the shape of a crescent on the prescutum (Fig. 1), did not occur on any male or female specimens of *Zenarge turneri turneri* from Wentworth Falls (Table C).

Certain colour characteristics were found to be variable in the various populations (Tables C and D).

The following specimens of *Zenarge turneri turneri* have also been examined: In The Australian Museum, 1 ♂ labelled "Wentworth Falls, A. Musgrave. No. K41049". In the British Museum, 1 ♀, 1 ♂, of the type series labelled "N.S.Wales, Sydney. 400 ft. Aug. 17, 1913. R. E. Turner. 1913-438". In the C.S.I.R.O. collection, 1 ♀ labelled "Mt. Rosea, Vic., 2 x 1954. A.N.". In the N.S.W. Department of Agriculture collection, 1 ♂ labelled "Wentworth Falls, N.S.W., 19 i 1955, K. M. Moore". In the Queensland Museum, 3 ♀♀, 3 ♂♂, labelled "Sydney-Sept. 1913".

About 300 specimens from Armidale, Wentworth Falls, Pennant Hills, Maroota, Kulnura, Lisarow and Broke were also examined.

A series of ♀♀ and ♂♂ has been lodged with each of The Australian Museum, the British Museum, the C.S.I.R.O., N.S.W. Dept. of Agriculture, Forestry Commission of N.S.W. and the Queensland Museum.

A series of larvae of each of the subspecies, fixed in K.A.A.D. and preserved in 90% alcohol, has also been lodged with each of the above Institutions.

To facilitate separation of the two subspecies, their biological and morphological characteristics are summarized:

<i>Zenarge turneri turneri.</i>	<i>Zenarge turneri rabus.</i>
(1) <i>Hosts.</i> <i>Callitris muelleri.</i> <i>C. rhomboidea.</i> <i>C. endlicheri.</i> <i>Cupressus sempervirens.</i> <i>C. macrocarpa.</i> <i>C. macrocarpa lambertiana</i> 'Aurea' (cultivar.). <i>C. macrocarpa</i> 'Aurea' (cultivar.).	<i>Callitris hugelii.</i>
(2) <i>Natural Distribution.</i> Coast and Highlands.	Western Slopes and Plains.
(3) <i>Size</i> (see Table A). Generally larger than corresponding sex of <i>Z. t. rabus.</i>	Generally smaller than corresponding sex of <i>Z. t. turneri.</i>
(4) ♀ <i>Coloration</i> (see Table B). (a) Hind tibiae with proximal quarter white. (b) Abdominal segments 7 to 9 usually with black dorsally, sometimes with restricted additional black markings on segs. 2, 3 and 6. Remainder of abdomen ferruginous.	(a) Hind tibiae all black. (b) All abdominal segments usually with black dorsally, but occasionally restricted to segs. 2 and 6 to 9. Remainder of abdomen lemon-yellow.
(5) <i>Venation</i> (Table C and Fig. 4). Rarely with prolongation of vein at apex of cell R ₁ in hindwing.	Rarely without prolongation of vein at apex of cell R ₁ in hindwing.
(6) ♀ <i>Saw</i> (Table E and Figs 5 and 6). With 6 or 7 lateral teeth.	With 8 or 9 lateral teeth.
(7) <i>Life-cycle.</i> Not longer than 18 months.	May continue to 6 years.

Coloration of the males is not significant for taxonomic purposes, but setae on the head, thorax and abdomen of ♀♀ and ♂♂ are more sparse in *Zenarge turneri rabus* than in *Zenarge turneri turneri* and punctures are smaller and more sparse.

Most of the wing venation was found to be variable, inasmuch as cross veins were often absent, or present only in part, or portions of veins were evident where they normally did not occur; even so, a small prolongation of the subcostal vein of cell R₁ of the hindwing (Fig. 4) was relatively constant in *Zenarge turneri rabus* and usually only doubtfully occurred in a few specimens of *Zenarge turneri turneri* (Table C).

A white mark, often in the shape of a crescent on the prescutum (Fig. 1), did not occur on any male or female specimens of *Zenarge turneri turneri* from Wentworth Falls (Table C).

Certain colour characteristics were found to be variable in the various populations (Tables C and D).

The following specimens of *Zenarge turneri turneri* have also been examined: In The Australian Museum, 1 ♂ labelled "Wentworth Falls, A. Musgrave. No. K41049". In the British Museum, 1 ♀, 1 ♂, of the type series labelled "N.S.Wales, Sydney. 400 ft. Aug. 17, 1913. R. E. Turner. 1913-438". In the C.S.I.R.O. collection, 1 ♀ labelled "Mt. Rosea, Vic., 2 x 1954. A.N.". In the N.S.W. Department of Agriculture collection, 1 ♂ labelled "Wentworth Falls, N.S.W., 19 i 1955, K. M. Moore". In the Queensland Museum, 3 ♀♀, 3 ♂♂, labelled "Sydney-Sept. 1913".

About 300 specimens from Armidale, Wentworth Falls, Pennant Hills, Maroota, Kulnura, Lisarow and Broke were also examined.

A series of ♀♀ and ♂♂ has been lodged with each of The Australian Museum, the British Museum, the C.S.I.R.O., N.S.W. Dept. of Agriculture, Forestry Commission of N.S.W. and the Queensland Museum.

A series of larvae of each of the subspecies, fixed in K.A.A.D. and preserved in 90% alcohol, has also been lodged with each of the above Institutions.

To facilitate separation of the two subspecies, their biological and morphological characteristics are summarized:

<i>Zenarge turneri turneri.</i>	<i>Zenarge turneri rabus.</i>
(1) <i>Hosts.</i> <i>Callitris muelleri.</i> <i>C. rhomboidea.</i> <i>C. endlicheri.</i> <i>Cupressus sempervirens.</i> <i>C. macrocarpa.</i> <i>C. macrocarpa lambertiana</i> 'Aurea' (cultivar.). <i>C. macrocarpa</i> 'Aurea' (cultivar.).	<i>Callitris hugelii.</i>
(2) <i>Natural Distribution.</i> Coast and Highlands.	Western Slopes and Plains.
(3) <i>Size</i> (see Table A). Generally larger than corresponding sex of <i>Z. t. rabus.</i>	Generally smaller than corresponding sex of <i>Z. t. turneri.</i>
(4) ♀ <i>Coloration</i> (see Table B). (a) Hind tibiae with proximal quarter white. (b) Abdominal segments 7 to 9 usually with black dorsally, sometimes with restricted additional black markings on segs. 2, 3 and 6. Remainder of abdomen ferruginous.	(a) Hind tibiae all black. (b) All abdominal segments usually with black dorsally, but occasionally restricted to segs. 2 and 6 to 9. Remainder of abdomen lemon-yellow.
(5) <i>Venation</i> (Table C and Fig. 4). Rarely with prolongation of vein at apex of cell R ₁ in hindwing.	Rarely without prolongation of vein at apex of cell R ₁ in hindwing.
(6) ♀ <i>Saw</i> (Table E and Figs 5 and 6). With 6 or 7 lateral teeth.	With 8 or 9 lateral teeth.
(7) <i>Life-cycle.</i> Not longer than 18 months.	May continue to 6 years.

TABLE A.

The original descriptions of *Z. t. turneri* adults gives the lengths as male 9 mm., female 10 mm. For comparison with the types, the following lengths of specimens of *Z. t. turneri* from Wentworth Falls, Armidale and in the Queensland Museum are given :

		Greatest.	Least.	Mean.
WF	14 ♂	10.0 mm.	8.5 mm.	9.2 mm.
	26 ♀	11.0 mm.	8.5 mm.	9.9 mm.
AR	17 ♂	9.0 mm.	7.0 mm.	8.0 mm.
	20 ♀	10.0 mm.	7.5 mm.	9.0 mm.
QM	3 ♂	9.4 mm.	8.9 mm.	9.2 mm.
	3 ♀	10.0 mm.	9.8 mm.	9.9 mm.

As contraction of specimens when drying is probably variable, the lengths in mm. of a forewing of adult specimen are given :

	<i>Z. t. turneri.</i>										<i>Z. t. rabus.</i>				X-					
	PH.		AR.		WF.		BM.	QM.		OL.	CR.	CR.	NA.	Lisarow.						
	♂	♀	♂	♀	♂	♀	♂§	♀§	♂	♀	♂	♀	♂†	♀†	♂	♀				
Mean (in mm.) ..	7.9	9.6	7.2	8.2	7.6	9.3	6.8	9.1	7.4	9.3	6.7	7.9	6.5	7.8	6.0	7.6	6.5	8.2	7.8	9.3
Number examined ..	22	10	16	24	82	71	1	1	3	31	19	27	49	1	1	41	23	65	15	
Average of means ..					♂ 7.4 mm.								♂ 6.4 mm.				♂			
					♀ 9.1 mm.								♀ 8.0 mm.				♀			
																	9.3 mm.			

Key to lettering in Tables A to E :

- AM=Australian Museum. DA=N.S.W. Dept. Agriculture. PH=Pennant Hills.
- AR=Armidale. DO=Dubbo. QM=Queensland Museum.
- BM=British Museum. MM=MacLeay Museum. US=United States National Museum.
- CR=Corringle S.F. NA=Narrandera. WF=Wentworth Falls.
- CS=C.S.I.R.O. OL=Olney S.F. X=Cross-bred.

* Paratype. † Holotype. ‡ Allotype. § Type series.

TABLE B.

Black Coloration on Dorsal Aspect of Female Abdominal Segments (Propodeum always Black).
(Numbers expressed as percentage.)

	<i>Z. t. turneri.</i>										<i>Z. t. rabus.</i>				X-	
	PH.	AR.	WF.	BM.	BM.†	QM.	CS.	US.*	OL.	CR.	CR.†	NA.	DA.	CS.	US.	Lisarow.
Black on segments :																
8 and 9	64	23	2	100		67										
7 to 9.. .. .	36	69	42		100	33		100								
6 to 9.. .. .			4	10												
2 and 7 to 9 ..				7		100										
2 and 6 to 9 ..		4	37					8	2					100	75	
2, 3 and 6 to 9 ..			2					3								
2 and 5 to 9 ..												50				
2, 3 and 5 to 9 ..								8	2							
2 and 4 to 9 ..								3	2							
2 to 9.. .. .								78	94	100	100	50	100			25
Number of specimens	11	26	88	1	1	3	1	1	39	177	1	34	4	1	1	15

TABLE A.

The original descriptions of *Z. t. turneri* adults gives the lengths as male 9 mm., female 10 mm. For comparison with the types, the following lengths of specimens of *Z. t. turneri* from Wentworth Falls, Armidale and in the Queensland Museum are given :

		Greatest.	Least.	Mean.
WF	14 ♂	10.0 mm.	8.5 mm.	9.2 mm.
	26 ♀	11.0 mm.	8.5 mm.	9.9 mm.
AR	17 ♂	9.0 mm.	7.0 mm.	8.0 mm.
	20 ♀	10.0 mm.	7.5 mm.	9.0 mm.
QM	3 ♂	9.4 mm.	8.9 mm.	9.2 mm.
	3 ♀	10.0 mm.	9.8 mm.	9.9 mm.

As contraction of specimens when drying is probably variable, the lengths in mm. of a forewing of adult specimen are given :

	<i>Z. t. turneri.</i>					<i>Z. t. rabus.</i>					X-									
	PH.		AR.		WF.		BM.	QM.		OL.	CR.		NA.	Lisarow.						
	♂	♀	♂	♀	♂	♀	♂§	♀§	♂	♀	♂	♀	♂†	♀†	♂	♀				
Mean (in mm.) ..	7.9	9.6	7.2	8.2	7.6	9.3	6.8	9.1	7.4	9.3	6.7	7.9	6.5	7.8	6.0	7.6	6.5	8.2	7.8	9.3
Number examined ..	22	10	16	24	82	71	1	1	3	31	19	27	49	1	1	41	23	65	15	
Average of means ..	♂ 7.4 mm.					♂ 6.4 mm.					♂		7.8 mm.							
	♀ 9.1 mm.					♀ 8.0 mm.					♀		9.3 mm.							

Key to lettering in Tables A to E :

- AM=Australian Museum. DA=N.S.W. Dept. Agriculture. PH=Pennant Hills.
- AR=Armidale. DO=Dubbo. QM=Queensland Museum.
- BM=British Museum. MM=MacLeay Museum. US=United States National Museum.
- CR=Corringle S.F. NA=Narrandera. WF=Wentworth Falls.
- CS=C.S.I.R.O. OL=Olney S.F. X=Cross-bred.

* Paratype. † Holotype. ‡ Allotype. § Type series.

TABLE B.

Black Coloration on Dorsal Aspect of Female Abdominal Segments (Propodeum always Black).
(Numbers expressed as percentage.)

	<i>Z. t. turneri.</i>					<i>Z. t. rabus.</i>					X-					
	PH.	AR.	WF.	BM.§	BM.†	QM.	CS.	US.*	OL.	CR.	CR.†	NA.	DA.	CS.	US.	Lisarow.
Black on segments :																
8 and 9	64	23	2	100	67											
7 to 9.. ..	36	69	42	100	33	100										
6 to 9.. ..	4		10													
2 and 7 to 9 ..	7		100													
2 and 6 to 9 ..	4		37	8		2	100		75							
2, 3 and 6 to 9 ..	2		3													
2 and 5 to 9 ..	50															
2, 3 and 5 to 9 ..	8		2													
2 and 4 to 9 ..	3		2													
2 to 9.. ..	78	94	100	100	50	100	25									
Number of specimens	11	26	88	1	1	3	1	1	39	177	1	34	4	1	1	15

TABLE C.
Comparisons of Variable Features of the Two Subspecies.
(Numbers expressed as percentages.)

	<i>Z. t. turneri.</i>										<i>Z. t. rabus.</i>										X-											
	WF.	AR.	PH.	BM.§	BM.¶	Q.M.	CS.	US.*	OL.	CR.	CR.	CR.	NA.	NA.	MM.	DA.	CS.	US.	USatow.													
	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀												
(a) Stub of vein at apex of cell R ₁ of hindwing (Fig. 4).																																
Present	0	6	28	24	0	0	0	0	0	0	0	0	0	97	96	97	92	100	100	92	97	100	—	100	100	100	0	100	0	83		
Absent	94	84	69	28	52	55	100	100	100	100	100	0	100	0	0	0	0	0	0	0	0	—	0	0	0	100	0	95	13	
Doubtful	6	10	25	44	24	45	0	0	0	0	0	0	3	4	3	8	0	0	8	3	0	—	0	0	0	0	0	5	54	
Number of specimens..	..	31	51	16	25	25	11	3	1	1	1	3	3	1	70	51	73	155	1	1	47	34	1	—	4	1	1	1	1	68	15	
(b) Dorsal white mark on prescutum (Fig. 1).																																
Present	0	0	23	0	40	0	100	0	100	0	0	0	16	74	2	52	0	100	25	69	100	—	100	100	100	100	100	0	0	
Number of specimens..	..	93	88	17	26	25	11	3	1	1	1	3	3	1	74	39	60	140	1	1	77	98	1	—	4	1	1	1	1	68	16	
(c) White on scutellum (Figs 1 to 3).																																
Posterior:																																
1/4 to 1/2	0	81	0	44	0	18	0	0	0	0	0	0	88	15	0	0	0	0	0	54	7	0	—	0	100	0	0	0	0	
1/2 to 3/4	0	19	0	56	0	82	0	100	0	100	0	0	11	5	0	0	100	0	34	12	0	—	—	0	0	0	0	0	0	21
3/4 to whole	100	0	100	0	100	0	100	0	100	100	100	0	0	5	93	14	0	0	0	0	0	—	—	0	0	0	0	0	100	0
Black spot anteriorly	0	0	0	0	0	0	0	0	0	0	0	0	1	75	7	86	0	100	12	81	100	—	—	50	0	0	0	0	79	
Longitudinal black bar anteriorly	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	—	—	50	0	100	100	100	0	0
Number of specimens..	..	93	72	17	23	25	11	3	1	1	1	3	3	1	75	39	60	138	1	1	73	98	1	—	4	1	1	1	1	68	14	

¶ Progeny of NA ♂ × WF ♀.
|| Progeny of WF ♂ × NA ♀.

TABLE C.
Comparisons of Variable Features of the Two Subspecies.
(Numbers expressed as percentages.)

	<i>Z. t. turneri.</i>										<i>Z. t. rabus.</i>										X-											
	WF.	AR.	PH.	BM.§	BM.¶	Q.M.	CS.	US.*	OL.	CR.	CR.	CR.	NA.	NA.	MM.	DA.	CS.	US.	USatow.													
	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀												
(a) Stub of vein at apex of cell R ₁ of hindwing (Fig. 4).																																
Present	0	6	6	28	24	0	0	0	0	0	0	0	0	97	96	97	92	100	100	92	97	100	—	100	100	100	0	100	0	83		
Absent	94	84	69	28	52	55	100	100	100	100	100	0	0	0	0	0	0	0	0	0	—	0	0	0	100	0	95	13	
Doubtful	6	10	25	44	24	45	0	0	0	0	0	3	4	3	8	0	0	8	3	0	—	0	0	0	0	0	5	54	
Number of specimens..	..	31	51	16	25	25	11	3	1	1	1	3	3	1	70	51	73	155	1	1	47	34	1	—	4	1	1	1	1	68	15	
(b) Dorsal white mark on prescutum (Fig. 1).																																
Present	0	0	23	0	40	0	100	0	100	0	0	16	74	2	52	0	100	25	69	100	—	100	100	100	100	100	0	0	
Number of specimens..	..	93	88	17	26	25	11	3	1	1	1	3	3	1	74	39	60	140	1	1	77	98	1	—	4	1	1	1	1	68	16	
(c) White on scutellum (Figs 1 to 3).																																
Posterior:																																
1/4 to 1/2	0	81	0	44	0	18	0	0	0	0	0	88	15	0	0	0	0	0	54	7	0	—	0	100	0	0	0	0	
1/2 to 3/4	0	19	0	56	0	82	0	100	0	100	0	11	5	0	0	100	0	34	12	0	—	—	0	0	0	0	0	21	
3/4 to whole	100	0	100	0	100	0	100	0	100	100	0	0	5	93	14	0	0	0	0	0	—	—	0	0	0	0	100	0	
Black spot anteriorly	0	0	0	0	0	0	0	0	0	0	0	1	75	7	86	0	100	12	81	100	—	—	50	0	0	0	0	79	
Longitudinal black bar anteriorly	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	—	—	50	0	100	100	100	0	0
Number of specimens..	..	93	72	17	23	25	11	3	1	1	1	3	3	1	75	39	60	138	1	1	73	98	1	—	4	1	1	1	1	68	14	

¶ Progeny of NA ♂ × WF ♀.
|| Progeny of WF ♂ × NA ♀.

TABLE D.
Coloration of Posterior Tarsal Segments.
 (Numbers expressed as percentages.)

Black on Segments.	<i>Z. t. turneri.</i>										<i>Z. t. rabus.</i>					X.		
	WF.	AR.	PH.	AM.	EM.†	BM.§	QM.	US.	CS.	OL.	CR.‡	CR.	NA.	MM.	DA.		CS.	US.
♂																		
1 to 3			4							45	100	42	45					
1, 2 (seg. 3 brown) ..	1									41		35	28				100	3
1 and 2	96	94	92		100	100			14			23	27	100	100			97
1 (seg. 2 part black or brown)	2	6	4	100			100											
1 only	1																	
Number of specimens..	157	16	24	1	1	3	3		70	1	26	40	1	3	1	1	1	65
♀																		
1, 2 (seg. 3 brown) ..					†	§			14	†	4	13						40
1 and 2		12							72	100	96	82			100			53
1 (2 part black or brown)	12	21	9			100		100	14							100		7
1 only	88	67	91		100							5						
Number of specimens..	86	24	11		1	1	3	1	36	1	46	22			1	1	1	15

TABLE D.
Coloration of Posterior Tarsal Segments.
 (Numbers expressed as percentages.)

Black on Segments.	<i>Z. t. turneri.</i>							<i>Z. t. rabus.</i>							X.			
	WF.	AR.	PH.	AM.	EM.†	BM.§	QM.	US.	CS.	OL.	CR.‡	CR.	NA.	MM.		DA.	CS.	US.
♂																		
1 to 3			4							45	100	42	45					
1, 2 (seg. 3 brown) ..	1									41		35	28				100	3
1 and 2	96	94	92		100	100			14			23	27	100	100			97
1 (seg. 2 part black or brown)	2	6	4	100			100											
1 only	1																	
Number of specimens..	157	16	24	1	1	3	3		70	1	26	40	1	3	1	1	1	65
♀																		
1, 2 (seg. 3 brown) ..					†	§			14	†	4	13						40
1 and 2		12							72	100	96	82			100			53
1 (2 part black or brown)	12	21	9			100		100	14							100		7
1 only	88	67	91		100							5						
Number of specimens..	86	24	11		1	1	3	1	36	1	46	22			1	1	1	15

TABLE E.
Characteristics of Saws of Females.

Transverse lines of serrations terminating in a single large lateral tooth (Figs 5 and 6).

NOTE: Saws of both subspecies also bear an apical hook not joined by a serrated transverse line, and 2 or 3 proximal transverse serrated lines each without a lateral tooth. The more proximal of these lines consists of vestigial serrations only.

Number of Lateral Teeth.	<i>Z. t. turneri.</i>				<i>Z. t. rabus.</i>				X-.	
	AR.	WF.	PH.	BM.§	CR.	CR.†	OL.	DO.	NA.	Lisarow.
6	2									
7	1	6	3	1						
8					3	1	2	1		3
9					3		1	2	3	
Number of specimens . .	3	6	3	1	6	1	3	3	3	3

Acknowledgements.

The writer is grateful to Mr. E. O. Pearson, Director of the British Museum (Natural History), and Dr. R. B. Benson, of that Institution, for the loan of a male and female specimen of the type series of *Zenarge turneri turneri*, and information concerning other specimens in their care; Mr. J. F. Gates-Clarke and Dr. B. D. Burks, of the U.S. National Museum, for information concerning specimens in the collection of that Institution; Mr. G. Mack, Director of the Queensland Museum, for the loan of the six specimens in that Museum; Mr. C. E. Chadwick, of the N.S.W. Department of Agriculture, Miss Elizabeth Hahn, of the Macleay Museum, University of Sydney, Dr. K. H. L. Key, of the Division of Entomology, C.S.I.R.O., and Mr. D. K. McAlpine, of The Australian Museum, Sydney, for the opportunity to examine specimens.

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NOTE: Saws of both subspecies also bear an apical hook not joined by a serrated transverse line, and 2 or 3 proximal transverse serrated lines each without a lateral tooth. The more proximal of these lines consists of vestigial serrations only.

Number of Lateral Teeth.	<i>Z. t. turneri.</i>				<i>Z. t. rabus.</i>				X-.	
	AR.	WF.	PH.	BM.§	CR.	CR.†	OL.	DO.	NA.	Lisarow.
6	2									
7	1	6	3	1						
8					3	1	2	1		3
9					3		1	2	3	
Number of specimens . .	3	6	3	1	6	1	3	3	3	3

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